DOCUMENT RESUME

ED 464 248 CE 083 208

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TITLE The Certificates in Science for Adults--Working towards Scientific Literacy.
INSTITUTION Language Australia, Melbourne (Victoria). Adult Education Resource and Information Service.
SPONS AGENCY Adult, Community, and Further Education Board, Melbourne (Australia).
ISSN ISSN-1443-7171
PUB DATE 2002-03-00
NOTE 6p.; Some parts of text may not reproduce clearly.
AVAILABLE FROM Language Australia, GPO Box 372F Melbourne, Victoria 3001, Australia. Tel: 61-3-9926-4794; Fax: 61-3-9926-4780; Web site: http://aris.com.au/.
PUB TYPE Journal Articles (080) -- Reports - Descriptive (141)
JOURNAL CIT ARIS Resources Bulletin; v13 n1 p5-8 Mar 2002
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Education; *Adult Students; *Curriculum Development; Developed Nations; *Educational Certificates; Foreign Countries; Postsecondary Education; *Science Education; *Scientific Literacy; *Student Certification; Technological Advancement; Technology
IDENTIFIERS Australia; Certificates in Science for Adults (Australia)

ABSTRACT

Australia's Certificates in Science for Adults (CSA) are designed for adults who left school early and/or who did not pursue science at school and who now want to improve their knowledge, understanding, and skills. The curriculum aims to advance purposes of diverse learners; provide adult students with credentials recognizing competence in science; and provide a range of education and training pathways. Issues and viewpoints that influenced it and shaped the view of science it promotes include scientific literacy and the science-technology relationship. Main emphases are that scientific questions and issues should be derived from curiosity about everyday experiences and adults should be able to read with understanding articles about science in the popular press, identify scientific issues and activities in their personal and local communities and on national and international bases, express scientifically and technologically informed opinions, think about and question the quality of scientific information, and understand scientific concepts and processes at the level needed for their everyday lives and experiences. Within each content area, these aspects of science have been identified: science inheritance, ethics, research, practical skills, and representation. The CSA has a series of modules at each of the first three levels of the Australian Qualifications Framework. The modules are Science in the Community; Exploring Science; Reading and Writing; and Numeracy and Mathematics. (YLB)

The Certificates in Science for Adults—Working towards Scientific Literacy

Dave Tout

ARIS Resources Bulletin
v13 n1 p5-8 Mar2002

The Certificates in Science for Adults – working towards scientific literacy

*By **Dave Tout**, Language Australia, and member of the development and writing team for the new Certificates in Science for Adults.*

The Certificates in Science for Adults are a new set of further education certificates at AQF levels I, II and III. They are designed for adults who left school early and/or who did not pursue science at school and who now want to improve their knowledge, understanding and skills in science.

WHY A NEW SCIENCE CURRICULUM?

The growing need for science and technology in the workplace and community requires that adults have a broad understanding of scientific concepts.

Many adults want a better grasp of science to understand and have greater control over their daily lives, to make informed decisions about their lifestyles, their environment and the kind of society and world they live in. Science and technology is often a key driver of change and adults often want a greater understanding of the scientific advances which affect every area of their lives. They want to know about a range of scientific areas for personal interest and development and to allow them to participate more fully in the community.

Equally important is that knowledge and understanding in science can help adults follow a broader range of further education and employment pathways. The Australian and global economy relies increasingly on scientific developments and on a workforce skilled in these areas.

The broad aims therefore of the curriculum were to:

- advance the purposes of diverse learners who need science for personal, civic, employment and further study related purposes;
- provide adult students with credentials recognising their competence in science; and
- provide a range of education and training pathways.

SCIENCE IN THE CERTIFICATES

Most science curricula from the past have now been criticised as content heavy, with (school based) curriculum focusing on content coverage, leaving teachers and students little time for the reflection required to build understanding or to cope with science in the context of their everyday lives. On the other hand,

> *"the ever-growing importance of scientific issues in our daily lives demands a populace who have sufficient knowledge and understanding to follow science and scientific debates with interest, and to engage with the issues science and technology poses-both for them individually, and for our society as a whole"*
>
> (Millar & Osborne, 1998, p. 1).

It was therefore an important that investigations were undertaken into how to describe science within a curriculum framework in a different, innovative and creative way that would avoid the pitfalls of traditional content-based science curricula. A number of issues and viewpoints were important influences on the curriculum and shaped the view of science it promotes. Some of these are discussed below and include the issue of scientific literacy, and the relationship between science and technology.

SCIENTIFIC LITERACY

A recent description of science education was given in the DETYA report "The Status and Quality of Teaching and Learning of Science in Australian Schools."

> *"Science is an essential part of the education of all students. The study of science as a way of knowing and a way of doing helps students to reach deeper understandings of their world. However, there is little point in learning about science unless it is of benefit to people in their everyday life."*

This report goes on to argue that science education should have as its major focus "scientific literacy". The description that they use for scientific literacy comes from the US National Science Education Standards (National Science Council, 1996).

> *"Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express opinions that are scientifically and technologically informed. A literate citizen should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.*
>
> *Individuals will display their scientific literacy in different ways, such as appropriately using technical terms, or applying scientific concepts and processes. And individuals often will have differences in literacy in different domains, such as more understanding of life-science concepts and words, and less understanding of physical-science concepts and words.*
>
> *Scientific literacy has different degrees and forms; it expands and deepens over a lifetime, not just during the years in school. But the attitudes and values established toward*

'science in the early years will shape a person's development of scientific literacy as an adult." (p. 22).

SCIENCE IN THE PISA PROJECT

Another important study is the work of the Programme for International Student Assessment (PISA) in school science achievement. The PISA project assesses scientific literacy in three dimensions.

The first dimension, scientific concepts, is seen to be needed to understand certain phenomena of the natural world and the changes made to it through human activity. In the PISA framework, the concepts need to be applied to real-life scientific problems rather than just recalled as facts.

The second dimension, scientific processes, is centred on the ability to acquire, interpret and act upon evidence. PISA names five such processes:

- the recognition of scientific questions
- the identification of evidence
- the drawing of conclusions
- the communication of these conclusions
- the demonstration of understanding of scientific concepts.

The third dimension, scientific situations, is about science being situated within a context. These scientific situations come mainly from people's everyday lives in contexts ranging from the personal or private to wider public, sometimes global issues often selected from the work of professional scientists.

The PISA concept of scientific literacy makes the role and importance of understanding and knowing about science, including its concepts and processes, explicit. However, underpinning both descriptions is the application, appreciation and critique of science in people's everyday lives.

SCIENCE AND TECHNOLOGY

The relationship between science and technology is an important one that needs to be discussed in any science curriculum framework. The two are intrinsically linked as technology is about the use and application of scientific concepts. The increased use of technology in our society has made it important to not only be able to appreciate and value technology, but also to be critical and questioning of its impact.

In this curriculum framework, technology issues and concepts have been integrated into the broad concept of scientific literacy, rather than being addressed separately. Technology issues will therefore be an important and vital part of the teaching of science within the Certificates in Science for Adults.

THE DISCOURSES OF SCIENCE

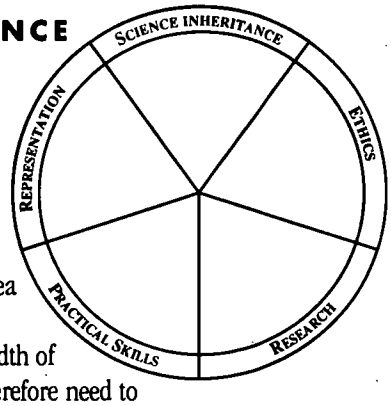
Helme and Javed, in their article *Unpacking Science and Technology: Science and Technology literacy in ALBE* (1994) also enter into detailed discussion of the meanings and interpretations of both science literacy and technology literacy. They describe three perspectives of science literacy: appreciation of science; learning about science; and the discourse of science (1994, p.29). Their concept of what science education should offer is similar to the others already discussed but also highlights the importance of science and technology discourses and the need for students to gain mastery of the language and numeracy skills that are an integral part of scientific literacy.

THE EMPHASES BEHIND THE FRAMEWORK

Based on the above views of science, technology and scientific literacy, the main emphases behind the proposed curriculum are:

- that scientific questions, issues and investigations should be derived from curiosity about everyday experiences
- that adults should be able to read with understanding articles about science in the popular press
- that adults should be able to identify scientific issues and activities within their own personal and local communities, including at work, as well as on a national and international basis
- that adults should be able to express opinions that are scientifically and technologically informed and to engage in social conversation about scientific issues
- that adults should be able to think about and question the quality of scientific information on the basis of its source and the methods used to generate it
- that adults should know and understand scientific concepts and processes at the level needed for their everyday lives and experiences.

ASPECTS OF SCIENCE



The certificates have been structured to ensure that the teaching, learning and discovering that takes place using this framework will offer adults a rich experience of science. Within each content area aspects of science have been identified which reflect the breadth of scientific enquiry and which therefore need to be addressed in the curriculum These include:

- science inheritance, which incorporates links to the past, an understanding of the present, and a perspective of the future role(s) of science;
- ethics, including the purpose, process and application of science;
- research activities, covering theoretical, laboratory and field research;
- practical skills of designing and setting up investigations; the ability to replicate other research or investigations, observational skills, and the understanding and use of appropriate technology; and
- representation and presentation which includes the ability to model, represent information pictorially or graphically, and in both written and oral forms.

These are reflected and incorporated into the structure and

organisation of the Learning Outcomes and the Assessment Criteria of the Certificates.

THE STRUCTURE

The Certificates in Science for Adults has a series of modules at each of the first three levels of the AQF, with modules comprising:

- Science in the Community
- Exploring Science
- Reading and Writing (from the Certificates in General Education for Adults - CGEA)
- Numeracy and Mathematics (from the CGEA). Structure of the Certificates in Science for Adults

Cert I in Science for Adults	**400 hrs**
Reading and Writing I (from CGEA)	100 hrs
Numeracy and Maths I (from CGEA)	100 hrs
Science in the Community I	100 hrs
Exploring Science I	100 hrs
Cert II in Science for Adults	**400 hours**
Reading and Writing II (from CGEA)	100 hrs
Numeracy and Maths II (from CGEA)	100 hrs
Science in the Community II	100 hrs
Exploring Science II	100 hrs
Cert III in Science for Adults (Further Study)	**500 hours**
Reading and Writing III from CGEA	100 hrs
Numeracy and Maths III (from CGEA	100 hrs
Science in the Community III	100 hrs
Exploring Science III. (Module 1)	100 hours
Exploring Science III. (Module 2)	100 hours

Each module is 100 nominal hours.

Science in the Community

Science in the Community is a series of learning outcomes that focus on many important aspects outlined in the descriptions of scientific literacy above -the need to be able to understand and be critical about how science has impacted on our way of life, and, as individuals and communities, to engage in debate on scientific issues.

Exploring Science

Exploring Science extends this to a deeper understanding and knowledge of science in order to interpret the world from a scientific perspective. It is about learning about the concepts and processes of science. It is also designed to encourage learners to use appropriate scientific language to express their understanding of these scientific concepts. At all levels the aim in these modules is to investigate science in context - it is not about science in isolation or out of context, but is about understanding and using science in our everyday lives.

Reading & Writing and Numeracy & Maths

Reading and Writing and Numeracy and Maths modules aim to provide the underpinning literacy and numeracy skills to enable ...rners to meet the specific requirements of the science modules. In ...ticular the Reading and Writing modules support many of the aims of scientific literacy, which involves the ability to read and communicate about science. It also addresses the important issue of learning about and understanding the discourse of science. Mathematics is seen as a core skill behind the learning of science at all levels.

Integrating modules & learning outcomes

The aim is that the science content be taught in a holistic manner where aspects of learning outcomes from across all the modules are integrated. In this way the Reading and Writing and Numeracy and Maths modules are seen as underpinning the learning of the scientific content. The Exploring Science modules will provide the scientific explanation of much of the science content that will be covered through the Science in the Community modules.

Certificate III level options

To complete Certificate III in Science for Adults, students need to complete an additional science module from the Exploring Science stream. The certificates offer five Exploring Science modules at this level and students must therefore select two of them. The five Exploring Science III modules included with the CSA are:

- Earth and Space
- Biodiversity and the Environment
- Matter, Motion and Energy
- Physical And Chemical Reactions
- The Living World.

Alternatively students can elect to complete comparable modules from other accredited Certificates at the appropriate level, giving a broader range of options in order to allow some specialisation and/ or the development of in-depth understanding in a particular field.

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A number of information sheets about the Certificates are being produced by the project team and will be available in the near future.

The Certificates in Science for Adults will be available shortly from the *ACFE Clearinghouse at ARIS, Level 4, 51 Queen Street, Melbourne*

Tel: *96122600*

Fax: *9612 2601*

Email: *sales@languageaustralia.com.au*

Cost: *To be advised*

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ISSN 1443-7171

Adult Education in the Community

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